How to Make Pre-point Charts using Guide 8/9

Ernest W. Iverson

A number of years ago Scotty Degenhardt developed a procedure for pre-pointing a telescope several hours before an occultation event was scheduled to occur. The telescope was precisely pointed so that the rotation of the earth would cause the target star to drift through the field of view (FOV) at precisely the right moment in time. This enables just one observer to set up a number of remote telescopes spread across the shadow path of the asteroid. This was a significant step forward in our ability to observe and occultation event. Key to this technology was Scotty figuring out where the target star was going to be in the sky at any given time. This was accomplished using Guide 8 and later Guide 9. In XXXX Scotty moved on to other interests and I took over the task of providing custom pre-point charts to some of the IOTA multi station observers and other observers who requested them.

This illustrated tutorial is broken up into 4 basic parts. The first part defines the Guide settings which, as a rule, do not change either between charts in a series or between occultation events. These instructions are written using an early version (16 Aug. 2011) of Guide 9 but they should apply equally to Guide 8 (except as noted). In general, they are the same settings that Scotty Degenhardt taught me to use. They may not be the best settings or exactly fit your preferences, but the charts that were produced using them have successfully supported observers in the field for a number of years. When it is all over except the data analysis, isn't that's all that's required?

No attempt is made to explain the how or the why a particular setting is used or an option is selected. I have also not attempted to explain every option available. The reader is referred to the Guide 8 or Guide 9 manuals distributed by the Project Pluto for more information. Guide 8/9 programs also come with limited help that can be reached by clicking on the "Help" tab.

Part 1 - Setting Up Your Computer

1.1 Configuring the Tool Bar, the Settings tab.

A great deal of time and frustration can be saved by first adding a few "hot keys" to the tool bar. Begin by clicking on the **Settings** flag and then **Toolbar…** in the dropdown window (Figure 1). This will bring up another window (Figure 2) containing a list of all of the "hot keys" available. Select the hot key desired and then click on the ok button to turn it on. An asterisk will appear left side of the line indicating that this option has been selected. When finished click OK. The most useful keys are: go to level 3,4,5,6,7 and.10; Create post script file; and Clear trails

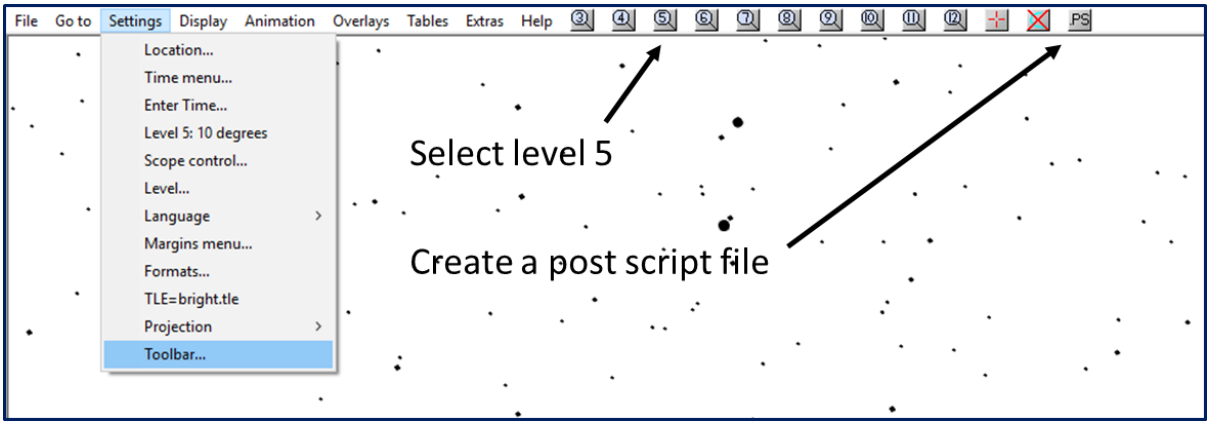

Figure 1. Selecting the tool bar hot key list. Arrows refer to the hot keys illustrated in Figure 2.

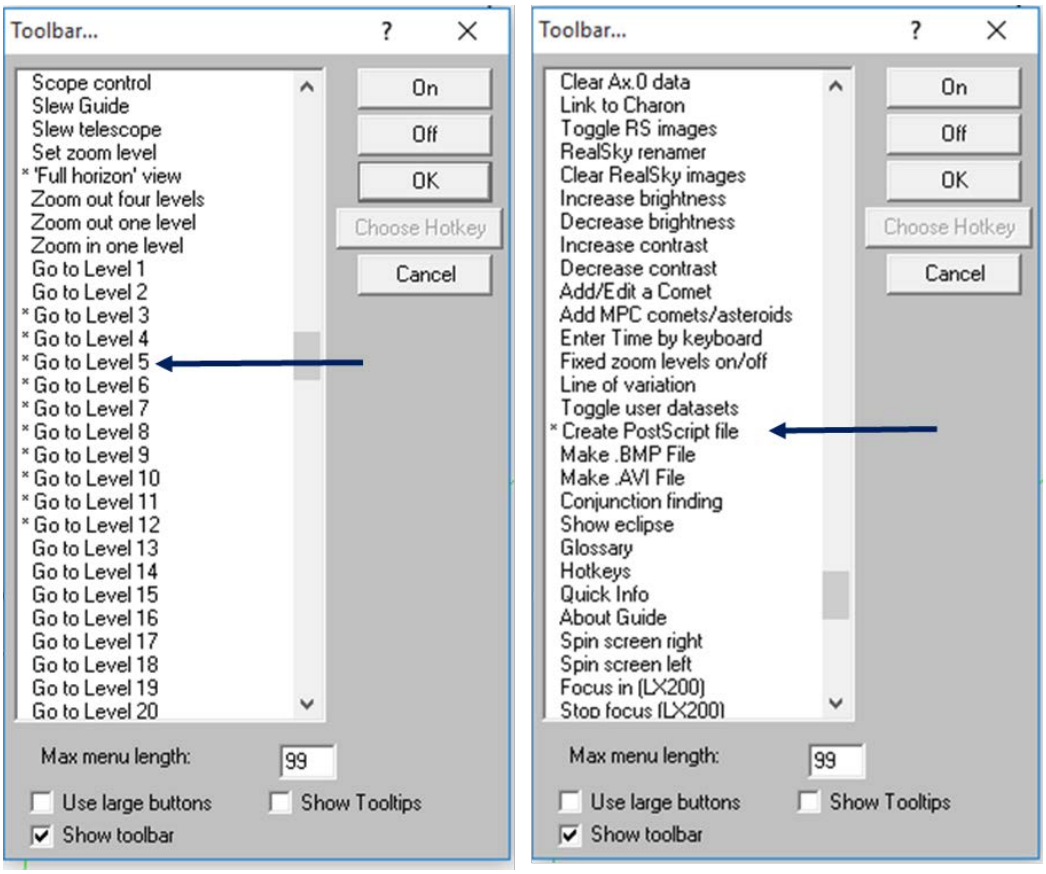

Figure 2. Two different copies of the pop-up window showing the locations where important hot keys are located in the list.

Next select your preferred format inputting or outputting positional data and time (Figure 3). From the **Setting**s tab select **Formats** in the drop down window. This will bring up the **Formats** window. Selecting **Time Format** will bring up the **Time Format** window.

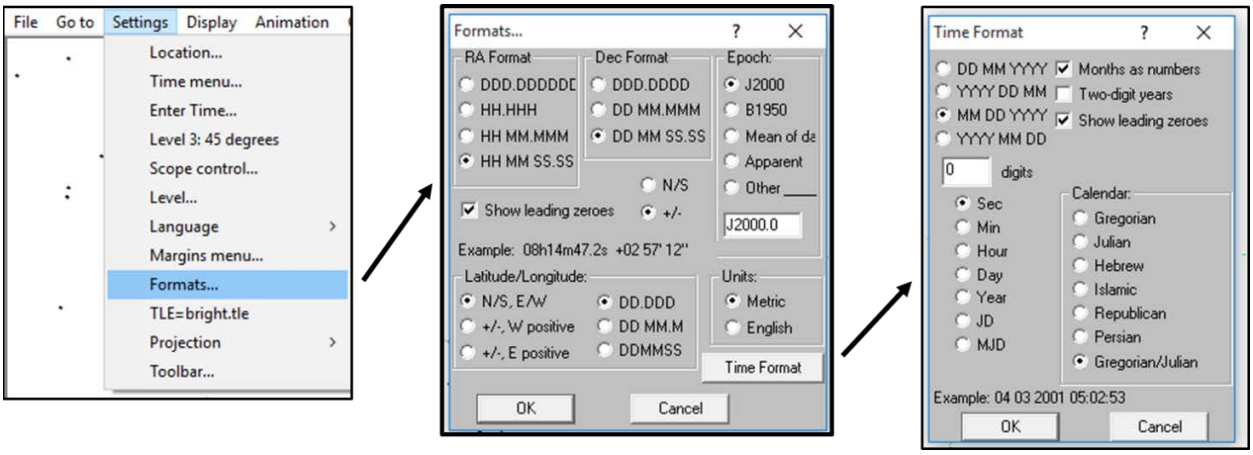

Figure 3. How to set up the data format for inputting and outputting position and time information.

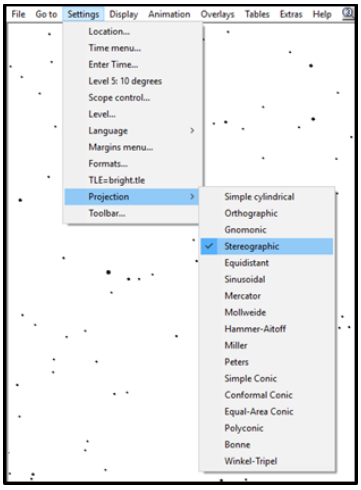

Figure 4. Selecting the appropriate projection.

While still in the **Settings** tab drop down window, select **Projection**. This brings up a window where you can set your desired sky chart projection. Check the **Stereographic** option (Figure 4). This automatically closes the window. The **Location** and **Enter time** options are very important, but they will be used later in the chart preparation process so skip them for now. The **Time menu…** option is complex, very busy, and an easy way to introduce an error. There is really no need to use this option so avoid it. Since we have already set up selecting the chart level displayed with a hot key, the **Level** option in this menu is not needed. The remaining options in the **Settings** drop down window are either not important or are self-explanatory

Although I don't recommend it, you can customize the field of view for each chart level. The fourth option from the top of the **Settings** drop down window will read something like **Level 5: 10 degrees**.

Selecting this option brings up the **Level Sizes** window. It is interesting to note the individual field of view sizes for each of the 20 available chart levels. If you absolutely feel the need to change a level field of view, this is where you do it. Doing so will probably void the recommended settings given later for reproducing standard charts.

1.2 Configuring the tool bar, the **Display** tab.

Selecting the **Star Display…** option will bring up the **Star Display …** window (Figure 5). For now, skip over the **Limiting Magnitude** option. We will come back to this frequently during the chart preparation process. It is recommended that you just copy these settings into your application of Guide 8/9. Changing the **Min star size** option significantly effects how the stars will look in the final printed chart. Increasing the size makes large stars and creates more clutter while decreasing the size results in small hard to see stars. Setting the **Min star size** to 1 seems to be a good compromise that is pleasing to the eye. Also note that the **Photometric band** is set to red (Rc) because that is the region of the spectrum where our CCTV cameras are the most sensitive.

For now, skip over the **Data Shown…** option, and select the **Legend…** option (Figure 6. This option will allow us to select the information displayed in the legend printed in the lower left hand corner of the chart. The **Caption text** box will be filled in when we begin making a set of charts. The **Mag key** and **Alt/AZ** options provide useful information that can help avert errors during the chart making process. These options will be discussed further in the section describing how to make charts. It is also useful to have the chart level and field size displayed on the chart. In order for the chart level to be displayed you must go to the **Extras** tab and select the **Fixed levels** option.

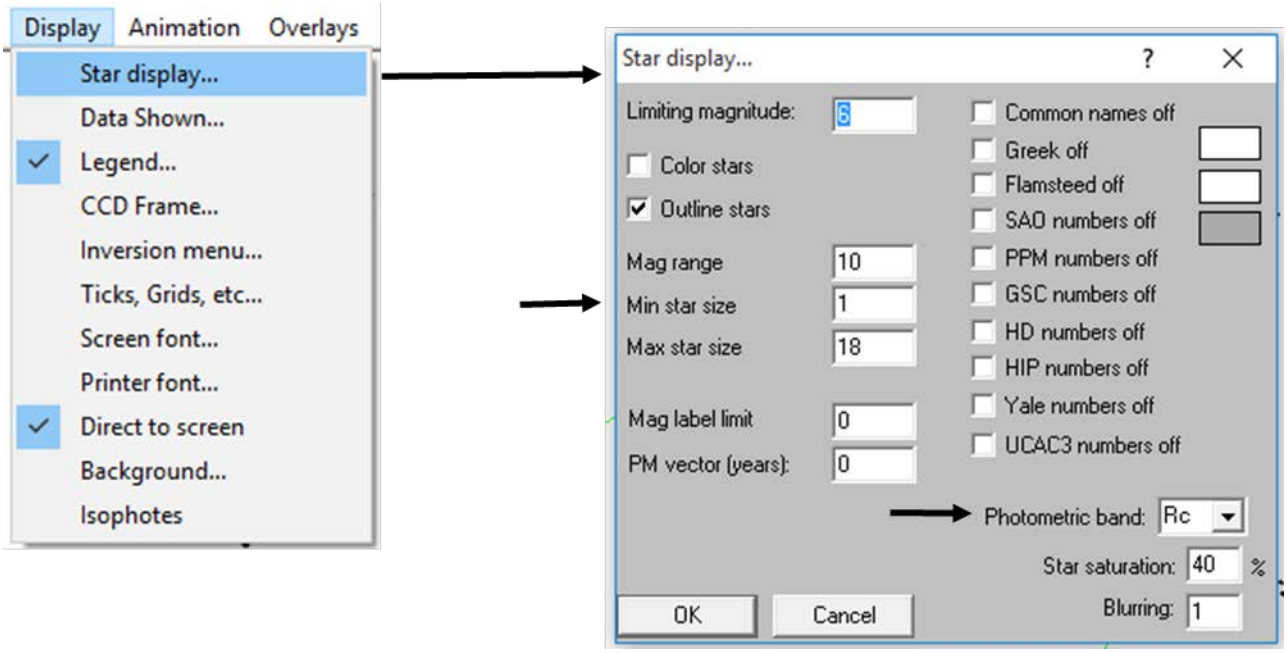

Figure 5. Configuring how the star will look on the chart.

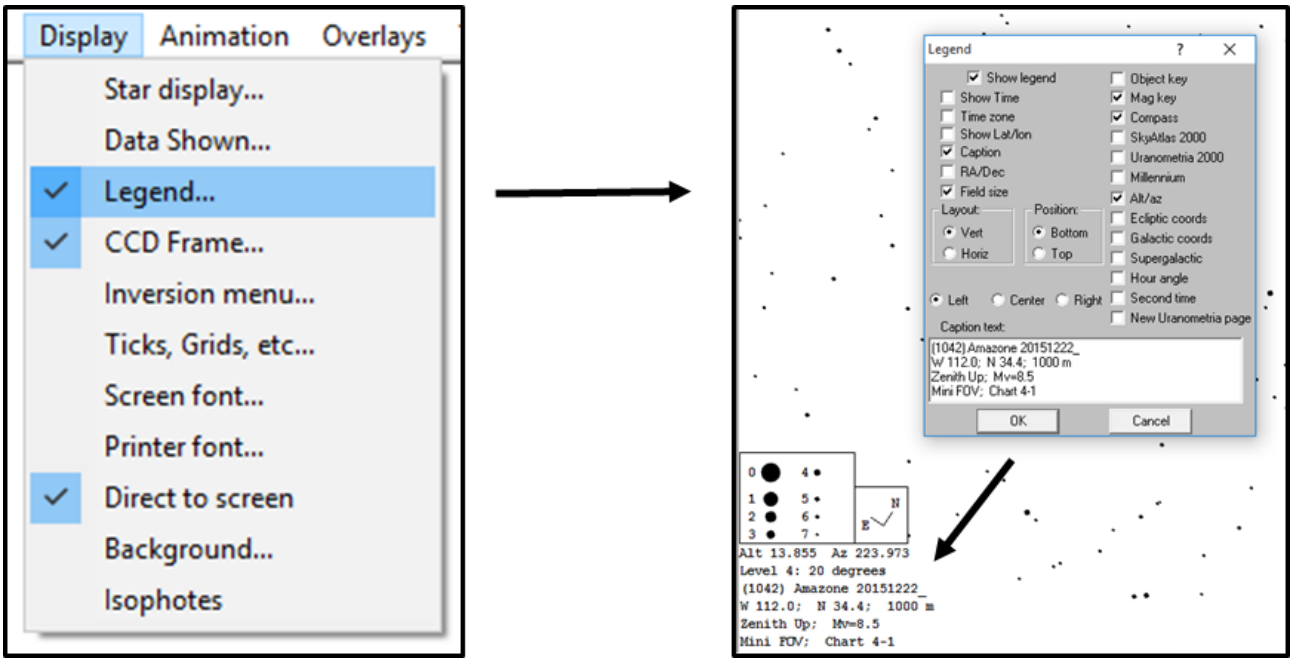

Figure 6. Configuring the static parts of the **Legend…** option.

Next let's configure the camera field-of-view box that is displayed on the charts. From the **Display** tab select the **CCD Frame…** option. This will bring up the **CCD Dialog** box (Figure 7). If you want the camera FOV to appear on your charts, then make sure the **Show frame** and **Center frame** boxes are checked. Angle gives you the ability to rotate the orientation of the camera FOV box. I find that it is best to leave this set to zero, but you may prefer something different. For now skip over the **Focal length** box. We will come back to this option in the chart making process. The scroll down window allows you to pick the camera you are using or one that has a similar chip size. For 1/3 inch chip video cameras us the **Supercircuits** option (PC-164C and variations) and for ½ inch chips select the **Watec (902H, 120N, etc**. option.

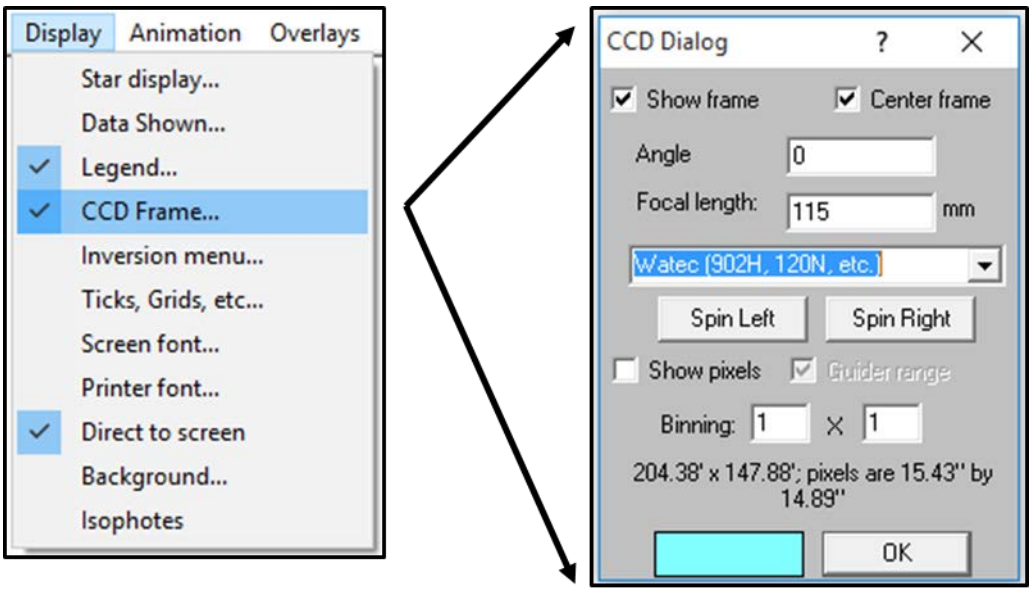

Figure 7. Configuring the camera FOV box.

It is important to tell Guide 8/9 what type of telescope and mount you are using. This is done by selecting the **Inversion menu…** option in the **Display** drop down box (Figure 8). This opens up the **Inversion** window. If you are using a refractor or SCT type telescope, make sure that the **Chart uninverted** box is checked. If you are using a Newtonian reflector or similar style telescope, then be sure to reverse the chart image by checking the **Mirror image E/W** option. Just remember that if using a Newtonian telescope, the associated finder scope field is probably not reversed. Therefore, remember to switch back to uninverted when making charts for the finder scope. It is easy to recall the **Inversion** menu box at any time by left clicking the **Compass window** in the legend. This assumes that the **Compass** option was selected (Figure 6).

If you are using an alt/az style telescope mount, then select the **Alt/Az (zenith up)** option in the **Inversion** window. If you telescope mount is equatorial, then select the **RA/Dec (north up)** option. **Rotation** should be set to zero and not changed.

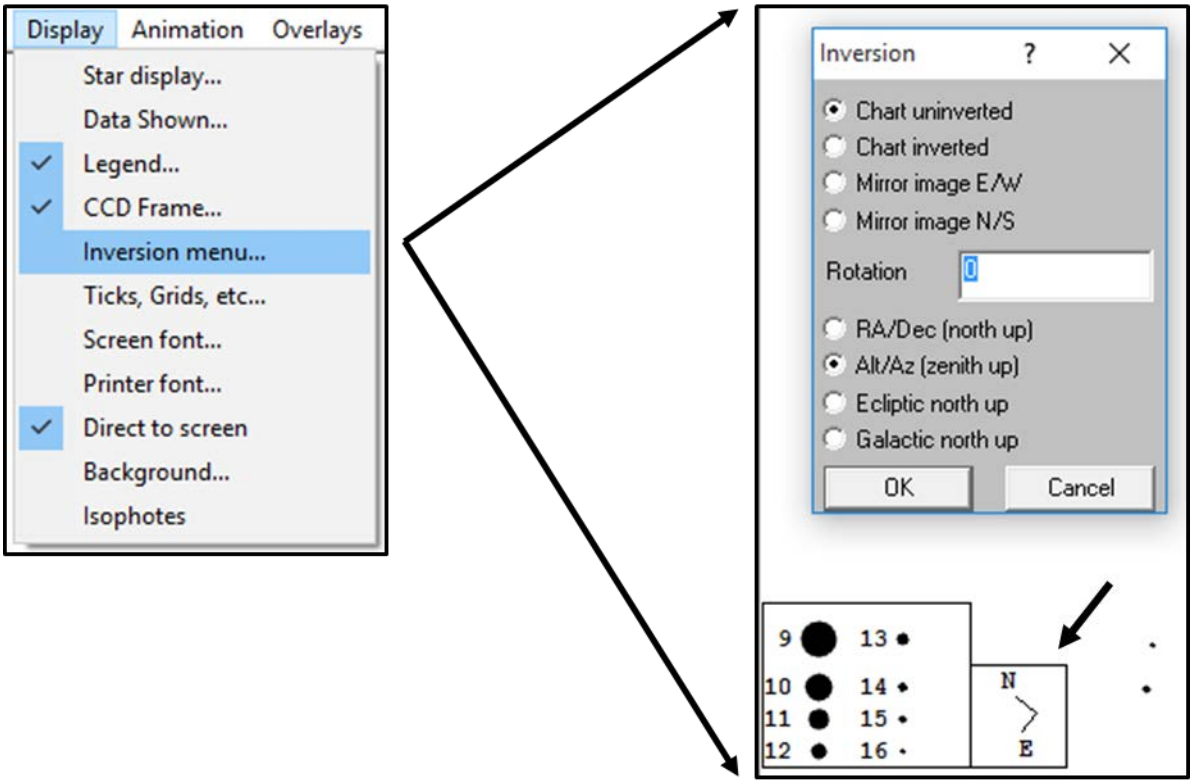

Figure 8. Setting the mount type and chart inversion options.

The **Ticks, Grids, etc.** option should be set up as shown in Figure 9. The **Screen font** and **Printer font** options can be set to your personal preferences. Figure 10 shows the settings I'm currently using. The **Direct to screen** option should be enabled. The **Background** option is self-explanatory and can be set to your personal preference. Unless you want the Milk Way displayed as a grey scale, the **Isophotes** option (Figure 11) should be turned off.

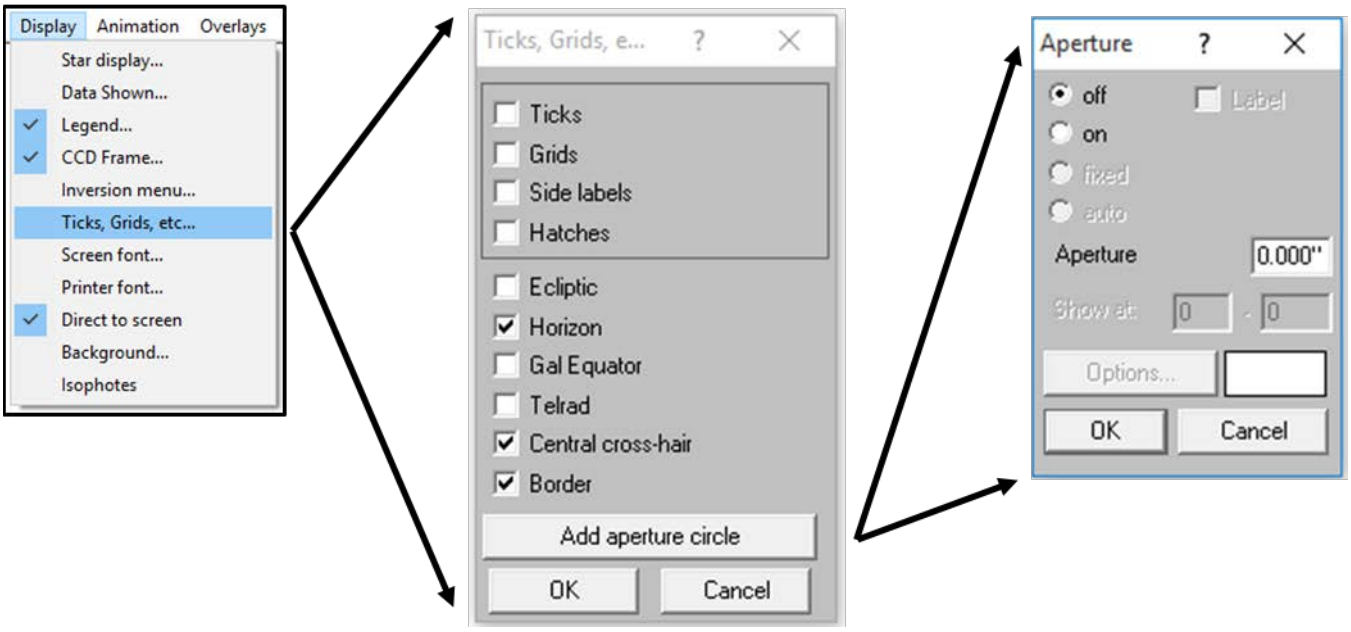

Figure 9. Configuring the **Ticks, Grids, etc**. option.

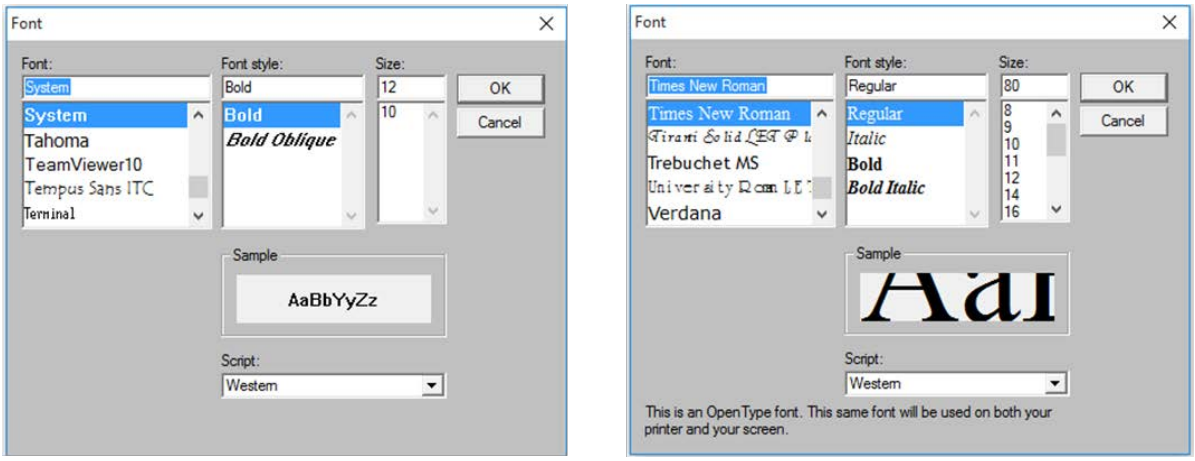

Figure 10. Suggested settings for the **Screen font…** option (window on the left) and the **Printer font…** option (window on the right).

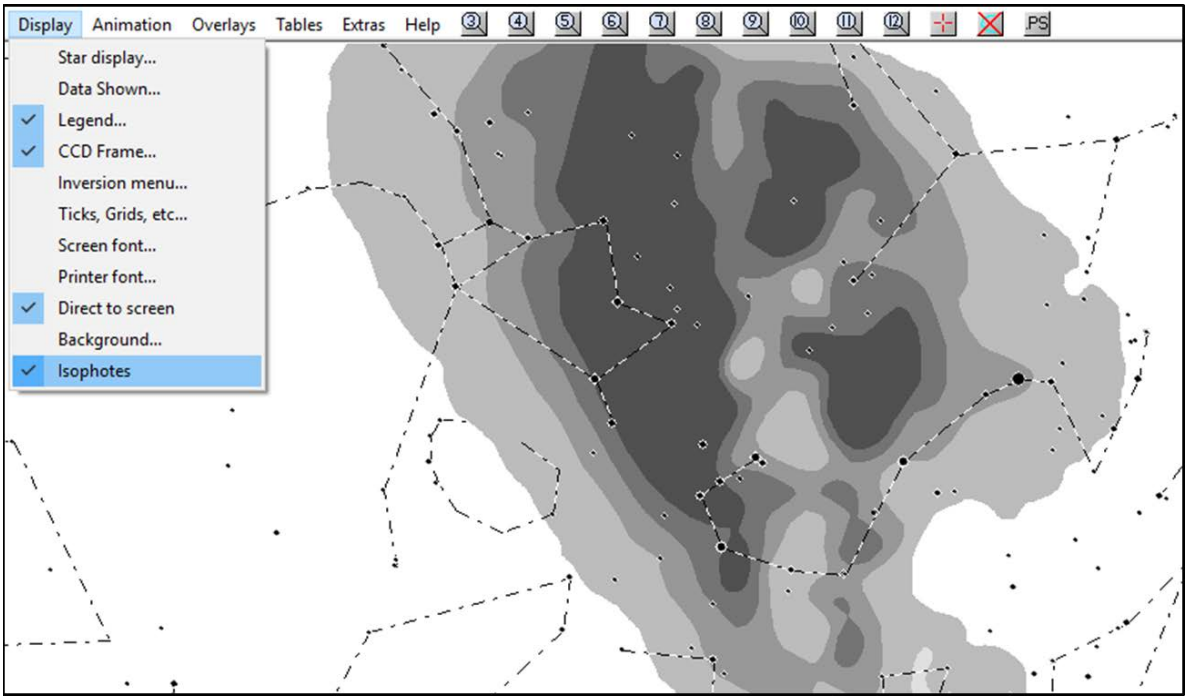

Figure 11. The **Isophotes** option is turned on to illustrate the shading of the Milky Way. Normally this option is turned off for chart making.

Skip over the **Animation** tab for now. We will come back to it when we make charts in the sext section. The **Tables** tab presents interesting tabular data that is not needed for producing charts so it can also be skipped.

Click on the **Overlays** tab and select the **Toggle overlay on/off** option (Figure 12). I find it useful to have the constellation lines displayed on the lower level charts. You can turn them on or off by selecting **Constellation lines** and clicking OK. This brings up a control window where you can turn them on or off, select the line type and color. By default, the constellation lines are shown the chart levels between 9 and 91 degrees (refer to the field of view settings given in the fourth option from the top in the **Settings** tab drop down window). At chart levels with a FOV greater than 91 degrees the constellation lines get crowded and at higher chart levels they convey very little information. Click OK to close each window. It is absolutely essential that the **Planet trails from animation** overlay be turned on. If it is not, then Guide 8/9 will not draw the time line needed to pre-point your telescope. The **Constellation boundaries** and **Constellation labels** options represent personal preferences and can be turned on if desired. The remaining options in the **Overlays** tab are not important and can be ignored unless they accidently get turned on and interfere with the time line.

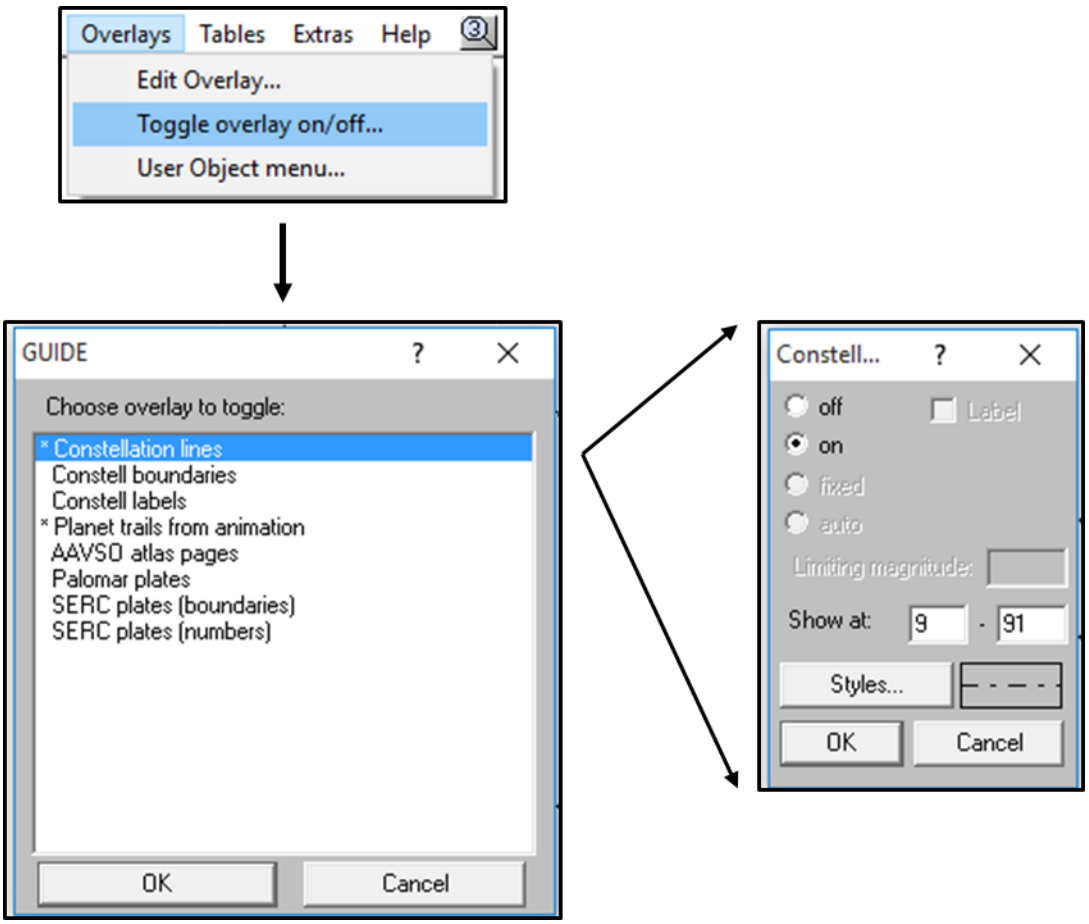

Figure 12. Setting up the desired overlay functions.

The **Extras** tab contains several important features that need to be addressed. The **DSS/RealSky images**, **Make BMP File**, and **Show eclipse** options are not needed to make pre-point charts and can be ignored. The **Fixed levels** option must be enabled for the chart level to be included in the legend.

Next we need to select the catalogue(s) that Guide 8/9 will use to create the pre-point charts. The base catalogue for Guide 9 is the UCAC-3 catalogue. I'm not sure but I think Guide 8 might use a version of the Gide Star Catalogue as the base. When Guide 8/9 is first installed the program installs just the essentials onto the hard drive from the distribution CD. Selecting the **Install to hard drive** option from the **Extras** tab drop down window brings up a window containing a list of data sets available. Select the data sets you want to install on your hard drive by right clicking each data set name (an asterisk appears to the left side). Clicking a second time removes the asterisk. Since I use Tera byte disk drives now I just select everything except the foreign language options. Clicking OK will install these data sets to your hard drive. A few of the star catalogues are too large for the full data set to be disturbed on a CD. To get the full data set you must download each catalogue from the internet using the VIZIER astronomical server. I've had to do this occasionally when a star did not show up in one of the data sets supplied on the distribution CD. The data supplied on the distribution CD is sufficient for over 95 percent chart making projects I've done.

First lets select the basic star catalogue(s) that Guide will use. Begin by clicking on the **Extras** tab and selecting the **Toggle user datasets** option in the drop down window. This will bring up the **Guide** window (Figure 13). The first thing you will notice is that a large number of data sets can be selected. Most of the data sets are not important to making pre-point charts, but the list also includes several large star catalogues that are important. Each data set can be turned on (placing an asterisk (*) to the left of the data set name or turning it off (removing the asterisk) by left clicking on the name to high lite it, and then clicking on **Adjust Dataset**. This bring up another window with the option to turn the data set on or off. Depending on the chart level, selecting the label option will cause either a few or all of the stars to be labeled. The Show at option functions in the normal way. In the case of the example shown in Figure 13, the GSC star field (Figure 14) will be shown on charts having a FOV less than 45 degrees. Using the default FOV values obtained by inspecting the **Settings** tab, **Level x….** option this star filed will appear on chart levels greater than 3. Note that showing this star field on a level 3 chart is not very practical because it is so small.

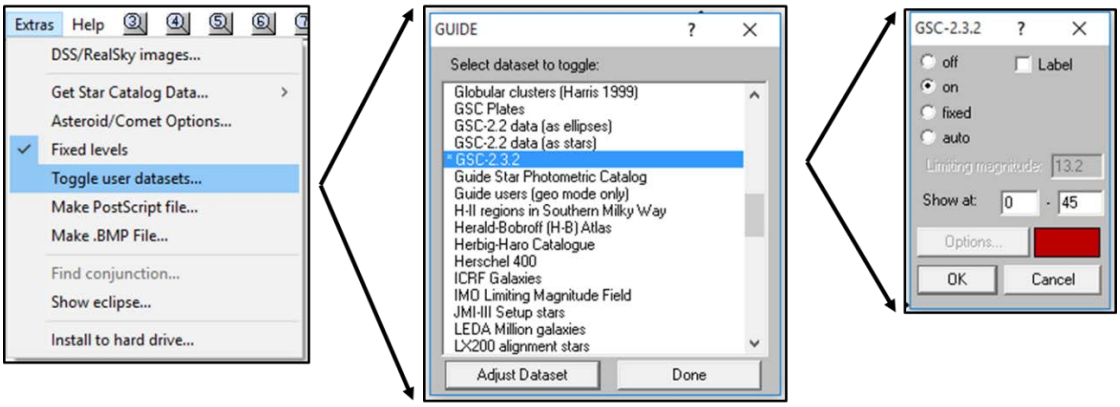

Figure 13. An example how to add star from one of the other available data sets. In this case the GSC-2.3.2 catalogue is used.

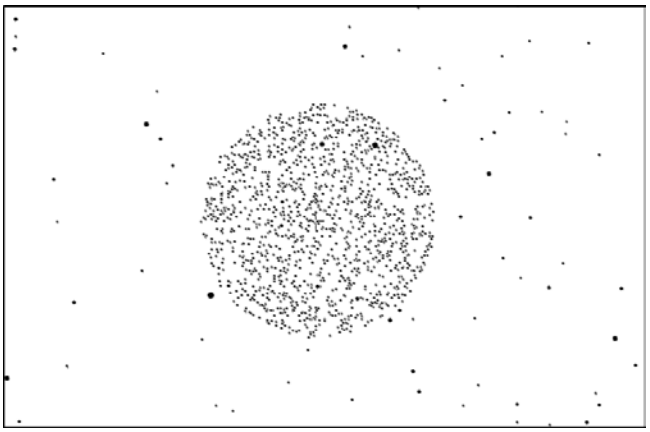

Figure 14. When selected, stars will be shown just in the region around the point selected. This example uses the GSC 2.3.2 catalogue. Remember to first download the catalogue using the VIZIER astronomical data server.

Part 2 - Making Simple Charts

I suspect that people who want to use Guide 8/9 charts will use also be using one or more simple refractor telescopes such as the Mini, Midi, or Maxi described by Scotty Degenhardt (reference) or one of the SCT models. Since Newtonian telescopes reverse the image right-to-left, the user needs to go through one additional step to reverse the Guide 8/9 charts east-to-west. Begin the "event dependent" setup steps by telling Guide where the station is located. You do not need a specific latitude and longitude. A latitude and longitude known to 0.1 degrees is sufficient. Higher precision is helpful especially with very large telescopes having a small field-of-view. Left clicking first on the **Settings** tab and then the **Location** option brings up the Location pop-up window (Figure 2.1). Previously we have defined how Guide 8/9 interprets latitude and longitude. I don't like using a minus or plus sign to indicate if the longitude is East or West (check). If you are West of the Prime Meridian, then call it West. It is just one less point where I can make an error. Enter the appropriate longitude, latitude, and altitude using the previously defined format. A precise altitude is not needed. The only thing it effects is the reported elevation. Elevation known to within 200 meters is sufficient. You can ignore the rest of the **Location** window. Close the window by clicking OK.

From the **Settings** tab next select the **Enter Time** option to get the Guide window (Figure 2.2). Previously we defined the data format for entering time and date information. In this case the format is mm-dd-yyyy hh:mm:ss. Enter the date and time the asteroid is predicted to pass in front of the target star and left click the OK box to close the window.. Both time and date should be in Universal time.

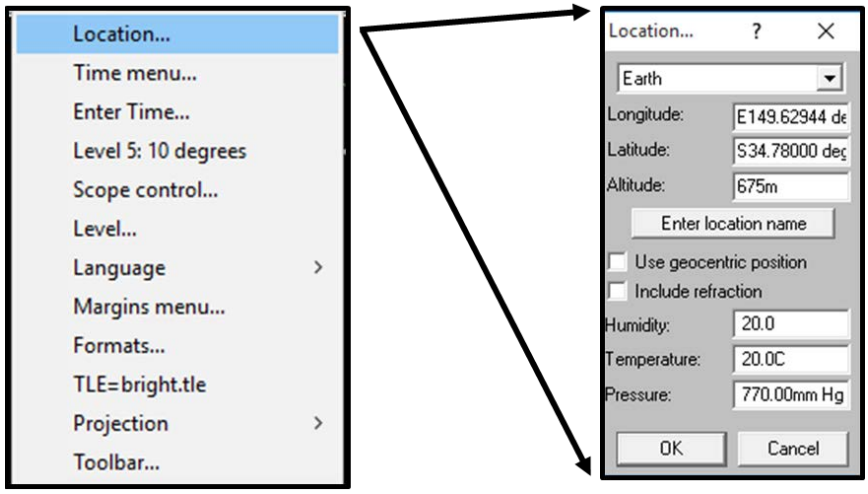

Figure 2.1. Input the latitude, longitude, and altitude for your station.

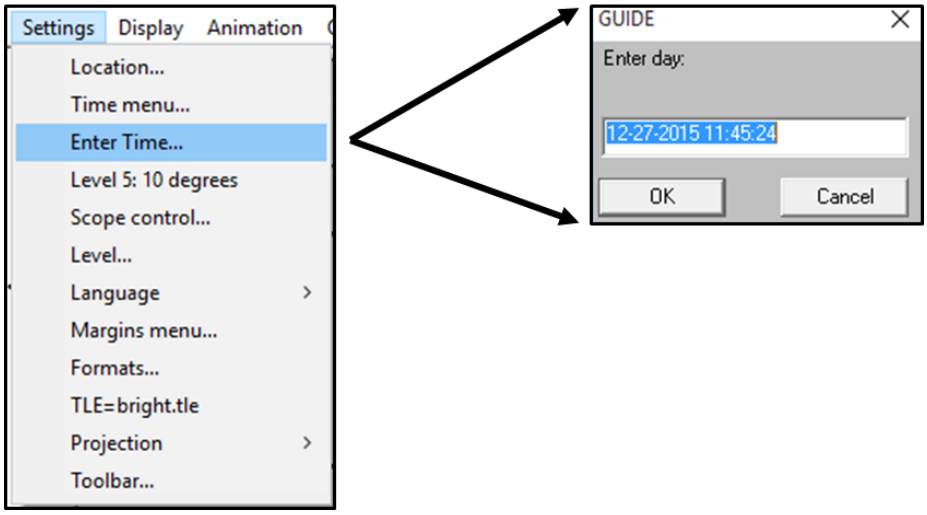

Figure 2.2. Input the date and time that the asteroid is expected to pass in front of the target star. The data format has been previously defined in section 1.

The next step is to enter the asteroid number. This time select the **Go To** tab and then the **Asteroid** option. Enter the asteroid number in the space provided and click OK. After clicking the OK button, the Guide 8/9 centers the asteroid in the center of the display. If you do not see the asteroid number, first check that the asteroid display function is turned on. Go to the **Display** tab and select **Data Shown**. The pop-up Data Shown window will appear. Make sure asteroid button is set to either **ON** or **Auto,** the asteroid label box is checked, asteroid label by number is checked. Most likely the magnitude setting is brighter than the magnitude. In this example the asteroid (1173) Anchises is

reported in Occult Watcher as 16.2 magnitude. Make sure the magnitude is set to something greater than 16.2 or in this example 16.5. Also make sure that the color used for printing the asteroid number has sufficient contrast with the background to be easily seen. For this example, the chart background is white so I've selected black as the print color. If the asteroid is still not visible, try viewing it on a higher level chart. Typically, I use lever 10 to check the alignment of the target star and asteroid. It is important to note that when you move between levels some settings also change to default values. This is a very good example. At level 6 the asteroid is not visible but it is visible at level10. So if you are ultimately going to make charts at level 6, then you must go back and change the magnitude setting in the **Data Shown** window if you want to see the asteroid location.

Usually the target star and asteroid line up fairly close to each other. Some variation is expected depending on how well the star and asteroid positions are known. Obviously older, less precise star chart will report positions different than the more recent high precision catalogs like UCAC4. If the target star does not seem to be present, then you will probably have to use a different catalogue. See xxxxxxxxxxxxxxxxx for help using a different catalogue. This will probably be a necessity if the target star is very dim. Especially with newly discovered asteroids, the asteroid ephemeris may not be in the Guide 8/9 data base. See section xxxxxxxxxxxxxxxxx for help downloading the current asteroidal positional data from the Minor Planets Center web page. For TNO events, getting a new ephemeris will probably be very helpful.

Once the target star and asteroid have been identified, right click on the target star to get the Guide pop-up window (Figure 2.5). Verify that the target star is correct. In this example the target is TYC 1882-01196-1, an 8.8 magnitude star in Gemini. The stellar magnitudes given in Occult Watcher and Guide 8/9 frequently differ slightly. Assured that we have the correct target star left click on the OK button. The window will close.

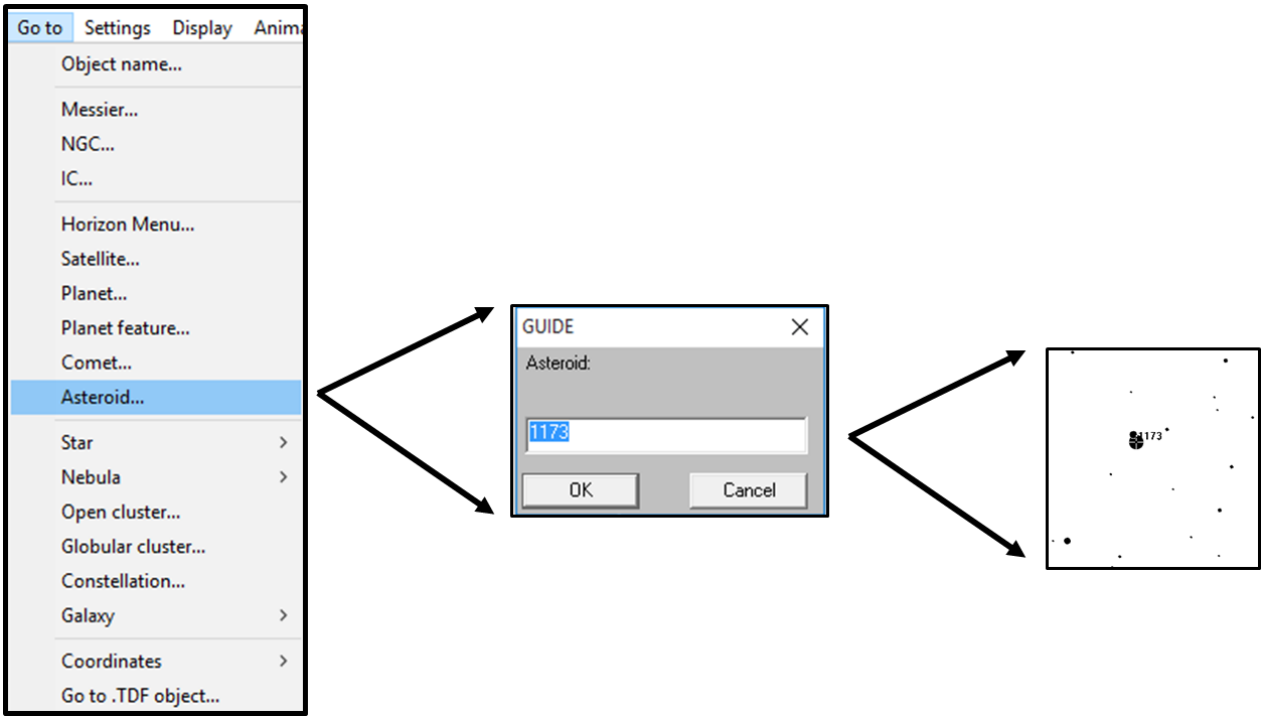

Figure 2.3

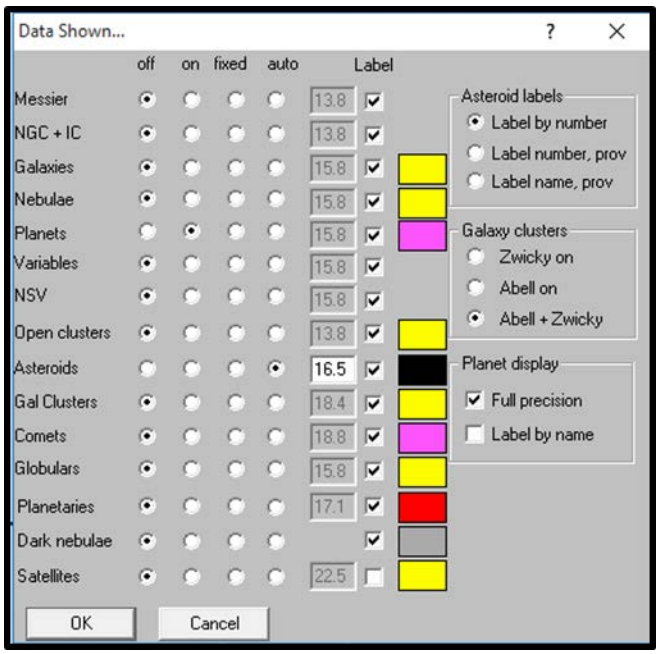

Figure 2.4

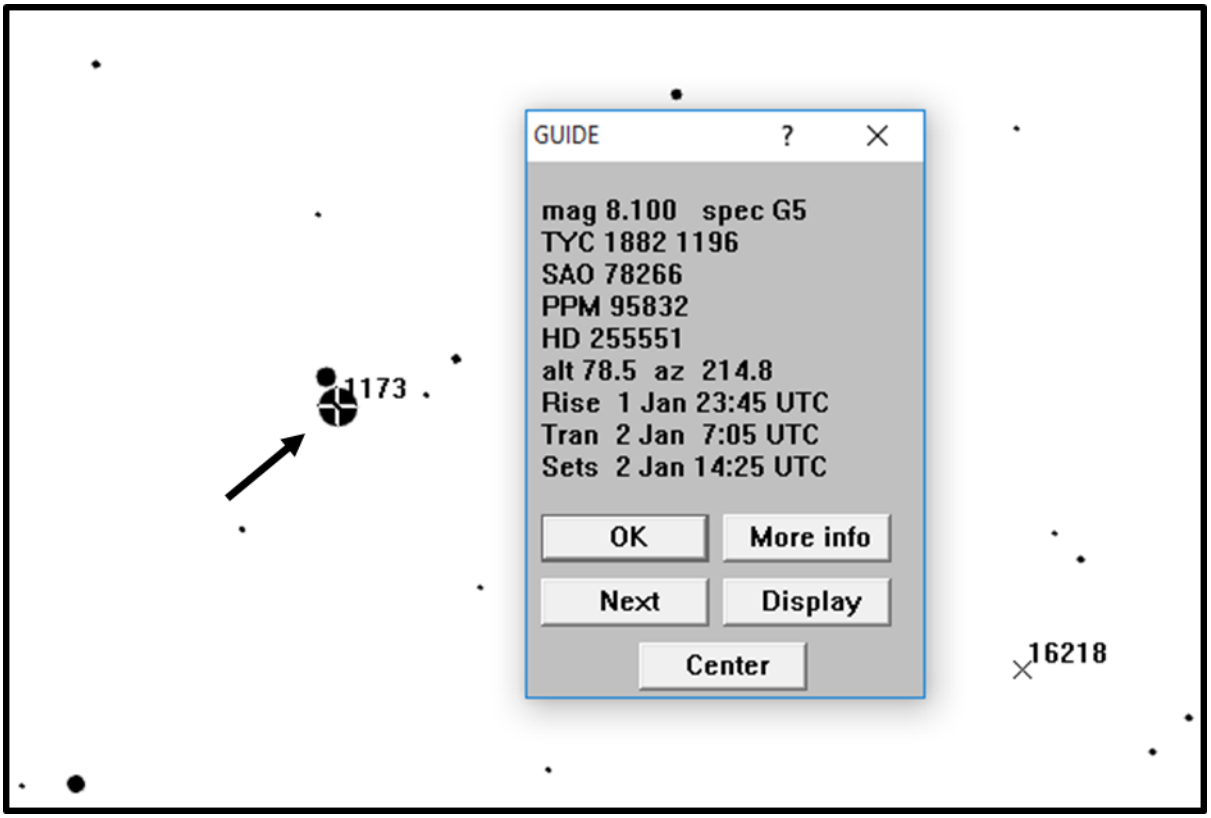

Figure 2.5. Verify that you have selected the correct star by left clicking on the star. Note that Guide 8/9 gives several catalogue names for the brighter stars. To verify dim stars, you may have to check additional astronomical data bases to find the correct catalogue conversion.

Next hold down the **Alt** key on the keyboard and the letter **J**. A Guide pop-up window will appear (Figure 2.6). Make sure that the number in the **Number of test flag** box is equal to 1. Setting this flag will allow you to create a time line in the next steps. Therefore, make sure you do not skip this step. Left click the OK button and the window disappears. Guide 8 has a known programing error that was corrected in Guide 9. My copy of Guide 8 requires that while holding down the **Alt.** key the letter **J** needs to be pushed twice.

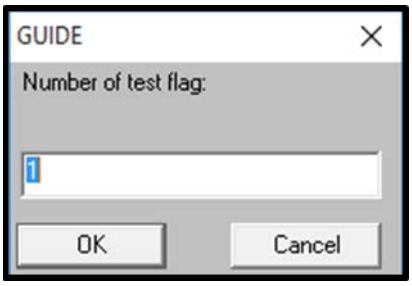

Figure 2.6.

On the tool bar, click on the **Animation** tab to get the drop down box.

On the CCD display, use the following focal lengths with the “Supercircuits” camera:
Mini, 80mm; Midi, 163mm; Maxi, 245mm; 10” suitcase scope, -415mm Reversed;
12” f5.2, 647mm

– – –

You wrote:

I've got most of the things figured out, but what is the focal length you use for the mighty mini, and the maxi? I assume that the maxi fl is 2.5 x 120 = 300mm; I'll check that with one of the previous charts you prepared, and should be able to use them to figure it out for the mini, too.

The formula for the FOV box is: Aperture in inches * 25.4 to convert to mm * focal ratio * focal reducer * 1.15 (Scotties fudge factor) = FOV. Scotty instructed me to always use the constants 115 for the Mighty Mini (note no decimal place; for a Runcam mini, about 90), 230 for the Midi (180 for Runcam), and 345 for the Maxi (but 270 when using a ½" chip like WAT and RumCam). He never told me the mini's focal length. It should be easy to calculate from the above information but it's not needed. For the 10 inch f/4 suitcase telescope I calculate a FOV value of 584 (but 438+ with 1/2in chip) and the value for the 12 inch with a 0.5 focal reducer is: 12*24.5*5.2*0.5*1.15= 879 (but 586 with ½" chip). For an 8in SCT with a 0.5 focal reducing lens and a camera with a 1/3in chip (like the Supercircuits PC164C-EX2), use 950; for 1/2in chip, it's 633. That's not right; Vince Sempronio says the FOV is 22′ x 15 ′ with a 0.33 focal reducer & 1/2in chip Runcam, meaning that for it, the focal length is 715; if a 0.5 focal reducer is used instead, it's 1072. For similar with a C14, it should be 950 *14/8 =1662. For the 16in Skywatcher without a focal reducer, use 900, that's pretty close [I think with the QHY 174 camera]. It's f/4.4 so it should be 16*24.5*4.4*1.15*2/3 for no focal reducer & Watec910HX (1/2in chip) = 1322. So with a 0.5 focal reducer, it should be 661. Observation shows that it's about 2/3rds that size, so with 0.5 focal reducer, it is about 990, and without it, it should be about 1980.
This is the most comprehensive, in c:\guide8\Guide9tutorialEl1.docx.

Your instructions end just when it gets interesting. I figured out before how to add the star trail, so I have that for the July 21Camilla occ'n. I suppose I just need to go to the coordinates for the first chart (just use RA of star - the time diff., with the same Dec), and use the first chart time. I can check that, I should be close with the alt. and az., but should be off a little due to both precession since the year 2000, and the sidereal/solar rate difference. But I assume that the trail is right, so the charts should be good. Then just step forward at the appropriate time interval, up to that of the event.

I need to pick up this project again and finish the tutorial. Once the trail is displayed I use the movement "menu box" obtained by clicking on the "Animation" tab. This produces a drop down menu. Left click on "Animation dialog" to display the movement menu. Be sure to set the horizon button and the appropriate time value. I then just use the arrow keys to move to the first chart at the end of the trail. Clicking the opposite arrow key moves the display in one chart width at a time. I don't need to know the RA for the star. We should probably sit down some time and you watch me make a set of charts. Precession has never really been a problem. Target stars and asteroids do not always plot together when viewed at a high level. If they are off too far it is because I've entered something wrong like the event time or the asteroid ephemeris is out of date.

The star is at J2000 RA 19h 30m 00.31s, Dec -9 deg. 59' 41,9", asteroid (107) Camilla

Event date 2016 July 21 7:42:04 UT; trail length 390 minutes (6.5 hours). Just using mighty mini finders, the f/5.2 12" Newtonian reflector (note, with 2 reflections, its field does NOT reverse; I'll set it up at home first, so only need charts for the first 3 hours for it), and the two 10" f/4 suitcase scopes (they have the camera at prime focus, so they DO reverse; will start setting them up no earlier than 4h before the event). If conditions are good, I'll also run one or two maxi stations for the 11.8-mag. star. Of course, using the 0.5 focal reducers for all scopes.

I'll make a set of charts later tonight if that is ok. I see the location is given in a later email.

Ernie